Analysis of Telecommunication Network Performance

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Abstract: - Telecommunication network uses the network of telecommunication devices. This paper gives analysis of the different means of communication in the Telecommunication industry. The main two applications of telecommunication arethrough internet or telephone. Antennas are used for the mobile communication through Base Transceiver Station (BTS) and Mobile Switching Centre (MSC)where network uses the bandwidth, trunks, routers and switching techniques. This paper gives the analysis of telecommunication network using two different technique which uses Frame relay switching, and ISDN.This paper also gives analysis of telecommunication devices such as Antenna, GSM module with AT commands, and Spectrum analyzer (3G, 4G).

Key-Words: - Antenna, GSM, Frame-relay, ISDN, BSC, MSC, Simulation

1 Introduction

Communication is one of the fast growing technology in the telecommunication industry to exchange the information. In this paper, we have used both telecommunication and network technologies to analyse the transmission time and performance of the communication. The networking technology still used in the Global System for Mobile Communications (GSM) technology such as Integrated Services for Digital Network (ISDN) plays the switching control centre in the mobile communication. The difference between the various communication technologies are wired and wireless configurations. In wired technology we have used for analysis purpose: Frame relay, ISDN and a small network, where as in wireless, the capability of the antennas, GSM module and the communication between the Base Transceiver Station (BTS) and Mobile Switching Centre (MSC).

Section 2 gives the background of telecommunication network. Section 3 explains implementation of telecommunication network using telecommunication devices and networking devices. Section 4 describes the analysis of the implementation results and conclusion is given in section 5.

2. Background

The general telecommunication network block diagram is shown in Fig. 1.

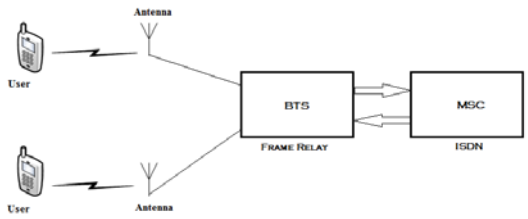

Fig.1 Telecommunication network

Telecommunication network is a network of various devices such as BTS, MSC, mobile phones, antennas etc [1]. This paper gives analysis of implementation of telecommunication networks using various tools and its performance such as the communication between the BTS and MSC and the radiation pattern of an antenna. Antenna 57-200 module has been used in obtaining the GSM module information and it's AT command to obtain the information about the GSM module and it's

working [2]. After the analysis ofimplementation of telecommunication interconnectivity, the capability of the network performance using Frame relay and ISDN have been used to compare different BTS and MSC as the switching technique for mobile communication.

3.Telecommunication implementation

Feedback Antenna 57 – 200, GSM trainer, FOTEX and Spectrum analyser are used in this experiment. Antenna 57-200 is used for the experiments with the various devices such as dipolar, multi-element yagi, bayed and stack yagi, Horn antenna, and Dish antenna [3] [4] [5].

In the ground reflection antenna the aluminium reflection pattern is fixed vertical in the position and the dipole antenna is connected to vertically to it. Extend the ends of the elements so that the total length of each dipole is 10cm. The spacing from the dipole to the plate is 5cms.

The frequency is set to the 1500 MHz, the radiation pattern for the ground reflection dipole antenna has been observed as shown in Fig. 2 and Fig. 3.

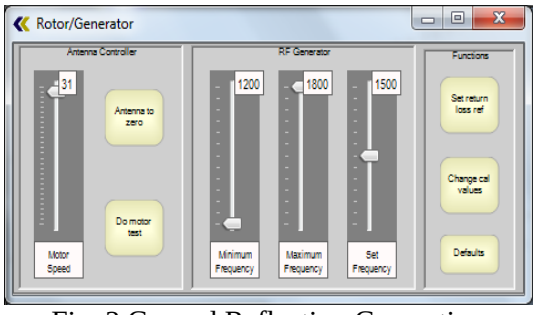

Fig. 2 Ground Reflection Generation

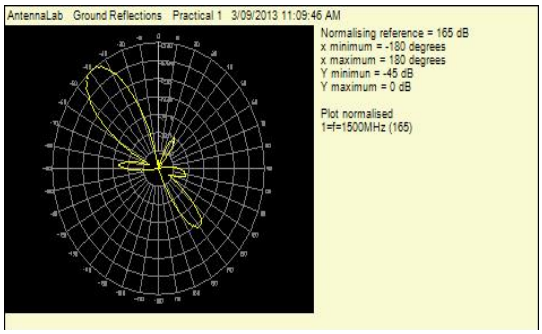

Fig. 3 Ground reflection radiation pattern

Antenna gain is shown in Fig. 4 below.

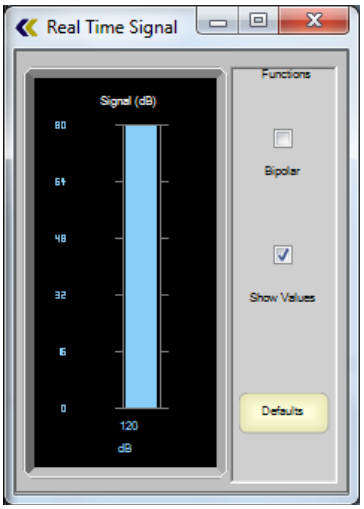

Fig. 4 Ground Reflection Gain in dB

The radiation pattern and reflection for the Monopole antenna are shown in Fig. 5 and Fig. 6.

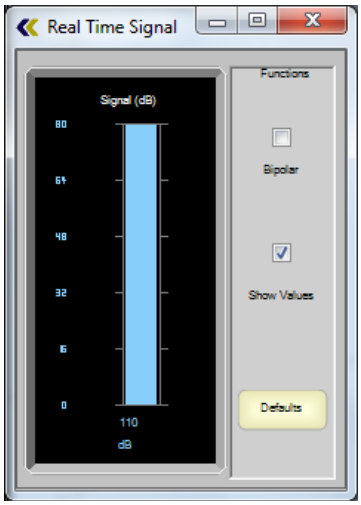

Fig. 5 Monopole Gain in dB

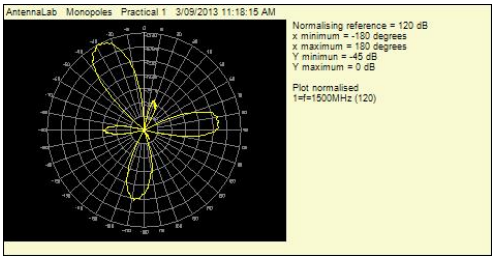

Fig. 6 Monopole Ground Reflection

After completion of the two antennas practicals, we did some experiment on by

connecting the antenna with the GSM trainer to observe its radiation pattern on the 57-200 antenna software.

After connecting GSM trainer with the antenna, we observed the GSM frequency is very less compare to the antenna transmission frequency gain. So, we could not find the frequency gain in the antenna radiation software. We observed only the default gain and the radiation pattern as shown in the below Fig. 7.

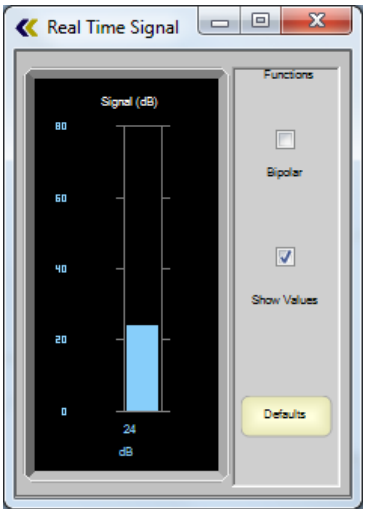

Fig. 7 GSM antenna gain

Conclusion of these implementations, is the radiation pattern of the antenna software is circular as shown in Fig. 8. Thus Feedback Antenna 57 – 200 transmission frequency radiation is much higher than the GSM frequency.

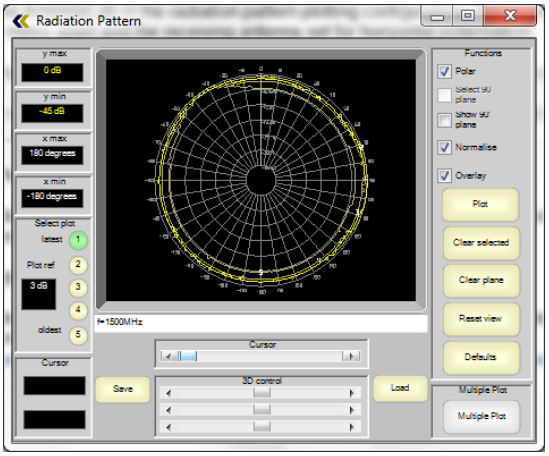

Fig. 8 GSM radiation pattern

3.1 GSM Technologies

GSM trainer has been used in the mobile and satellite telecommunication, which has the basic commands for modem and sim card, network registration commands, call processing control commands, call information commands, short message service and commands, message setting and commandsetc. [6] [7].

In this experiment, we configured networking using routers with the Point to Point (PPP) and Internet connection overPPP protocols. PPP is the oldest techniques used to have in GSM 2G technology when the GPRS came out in the market. The maximum speed of the GSM PPP dial up connection through mobile network is around 14 bits/sec in 2G technology and later it increased in 2.5G, 3G, 4G technologies. PPP frame has the following fields:

Flag – it is a single byte indicating the start or the end of the frame which is in 0's and 1's.

Address – This stores the standard broadcast address in the frame which is also in bits 0's and 1's.

Control – It controls the call transmission data from non-sequential frames.

Protocol –contains two bytes, to indicate PPP or HDLC or some other protocol.

Data –contains the data of the user or the transmission data stored in slot and the maximum length of the slot is around 1500 bytes per frame.

FCS – Frame check sequence, it checks the sequence number of the sending data usually in the frames and the default size of the FCS is 16 bits to improve the speed and the data error correction we can set it to 32 bits.

Firstly, started the GSM trainer and windows embedded CE 6.0 software in the module. After starting the GSM trainer open the "My device" and open "Control Panel".

In control panel check for the "network and dial-up connection" and the double click to open it.After opening the setup configuration through PPP dial up connection can be set up. Select dial-up connection and the communication link/port of the SIM module usually it should be COM1, etc. As shown in Fig. 9.

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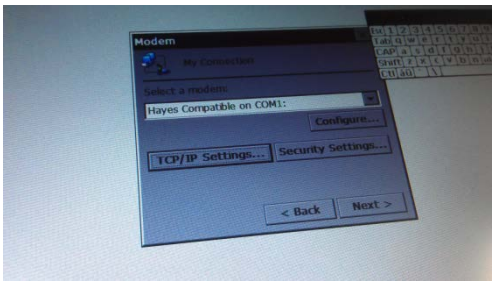

Fig. 9 GSM Trainer COM port

Configure the communication port values such as speed and flow control means security type as shown in Fig. 10:

Speed : 115200 bits

Flow Control: None (No security or firewall)

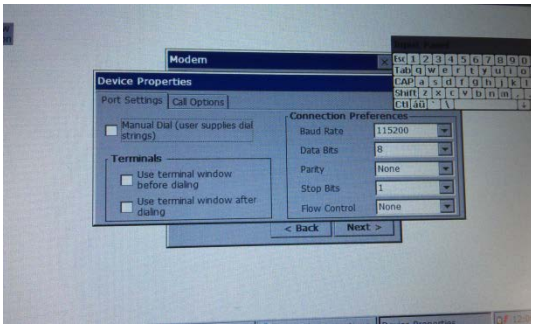

Fig. 10 GSM Modem Configuration

After configuring the port settings set up the call options shown in Fig. 11.

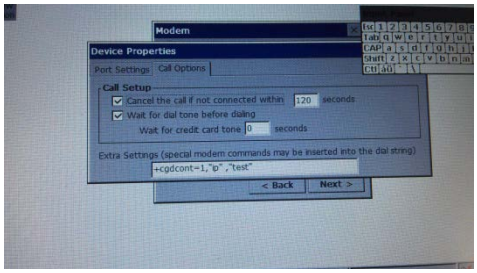

Fig. 11 GSM Dial up

Then select the TCP/IP setting from the modem configuration and set the DNS address to the connection as shown in the Fig. 12.

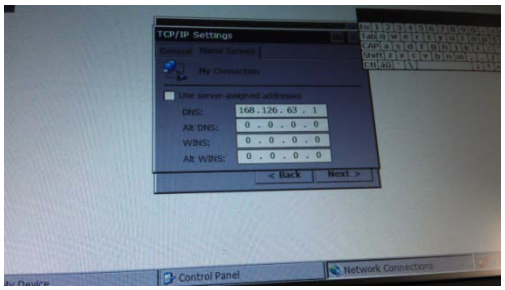

Fig. 12 GSM TCP/IP

Every internet connection need to be secure with the encryption and decryption in this PPP connection we are encrypting the data using MD5-Challege technology as shown in the Fig. 13.

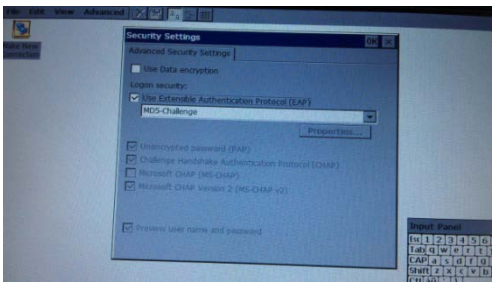

Fig. 13 GSM Encryption

After the encryption is set, we dialed the number to connect the internet, in our case its Vodafone which is having its dial-up number *99# and user name, password should be blanks as GSM service provider doesn't provide user name and password to every user. The Fig. 14 shows the dialing number and the login page.

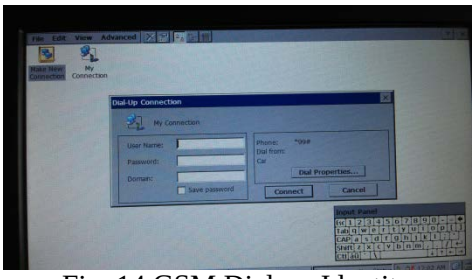

Fig. 14 GSM Dial-up Identity

At last the connection observed in the GSM trainer by connecting the dial-up connection and GSM trainer as a modem device to access the internet through the GSM service provider.

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4. Comparison of Telecommunication technologies

This section gives comparative analysis of the experimentation.

3.2.1 Ground Reflection Antenna

Ground reflection antenna using Feedback antenna Lab 57-200 has not been used in any research paper so far. Thus comparing with the similar experiments done by the researchers, we observed that the ground reflection antenna is mostly useful for the plane area and less terrain area.

Grid pattern of the antenna shows that antenna is reflected the proposed design consists of a rectangular loop, which has magnetic dipole characteristics, and a dipole antenna, which has electric dipole characteristics.

This concludes that the reflection pattern we used in our Feedback antenna lab is used for the plane area and ground reflection, and cannot be used for the hilly area or the highly terrain area. By compare our experimental results with the existing research papers experiment, the grid pattern is same but the gain in our antenna was much higher than other research paper. Thus we can also conclude that the distance between the two antenna is also helps to get the high gain signal to the receiver. Hence reflection can be done in the plane terrain not the highly or hilly terrain due to reflection of the signal on the object and helps to transmit.

3.2.2 Monopole

A monopole radio antenna is a class of radio antenna comprising of a straight pole formed channel, frequently mounted perpendicularly over some sort of conductive surface, called a ground plane[8] [9]. The driving sign from the transmitter is connected, or for appropriating receiving wires, the yield indicator to the beneficiary is taken, between the easier end of the monopole and the ground plane. One side of the receiving wire feed line is appended to the easier end of the monopole, and the other side is connected to the ground plane, which is regularly the Earth. This appears differently in relation to a dipole reception apparatus which comprises of two indistinguishable bar conductors, with the sign from the transmitter connected between the two parts of the radio wire.

Low-profile folded monopole receiving antenna are well-known radiators that can furnish expanded radiation resistance, as contrasted with the first ever monopoles, while holding the same self-resonance. The monopole antenna which we have usedin our telecommunication laboratorydiffers from the research paper, as we have given the frequency which was normalized to 1200-1800 MHz frequency; in the research paper the author is using more frequency which is around 3GHz.

As we compare to the return losses and the radiation pattern of the monopole antenna the ration pattern is less in our project because of its low distance and traffic/obstacle around the antenna.

As we compare both radiation pattern as shown in Fig. 15 to the research paper radiation pattern is much better due to the high frequency at the transmitting antenna and it is covering 2 sides which is reflected radiation is observed by scattering of the radiation. This shows the radiation of the signal is more in the research paper as they have used high end antenna and frequency but the application of the antenna is same [10].

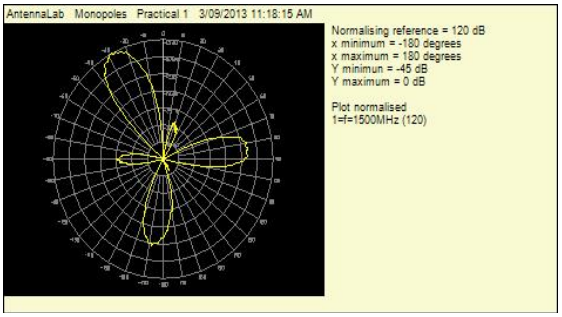

Fig. 15 Monopole radiation pattern

5. Conclusion

The comparison of the telecommunication networks with different telecommunication devices are discussed in this paper.

Results obtained from antennas used in the experimentation are useful for further analysis of power in terms of gain and performance in terms of speed. Communication protocols such as PSTN/ISDN used in the Mobile switching centre

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for switching the connections from one BTS to the other and the frame relay terminology is used in the BTS to connect the several BT to one BSC from different numbers etc. Thus the analysis of telecommunication network shows the terminology is same between both communication techniques and differs by wired and wireless.Our further research will investigate the effect of other factors such as environment, noise etc.

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